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Reply to Our Critics

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We are grateful to Tim Schroeder, Alva Noë, Pierre Poirier, and Martin Ratte for reading and criticizing our book. Interestingly, their three sets of comments (to which we shall respond in order) reflect three very different standpoints on both vision and the science of vision.

1. Reply to Tim Schroeder

Tim Schroeder is a very sympathetic reader indeed. He raises two queries, both of which are well taken and go deep to the heart of our framework.

His first question is about the scope and limits of our endorsement of a teleosemantic account of mental representations. On this account, a signal *S* is said to represent property *F* if the former has the function to track (or be correlated with) instances of the latter. As Schroeder notes, since this account involves the notion of tracking, it seems tailor-made for belief-like (or "indicative") mental representations with a mind-to-world direction of fit, whose function is to register the presence of facts or instantiated properties. Indeed, in the first section of Chapter 1, we do endorse this account for the contents of visual percepts.

The question Schroeder first raises is whether this teleosemantic account could be extended to the contents of intentions—motor intentions, in particular—which, unlike beliefs and percepts, are "imperative" mental representations with a world-to-mind (not a mind-to-world) direction of fit, i.e., whose function is not to record facts, but to represent non-actual possible states of affairs and to contribute to turning them into actual states of affairs. In particular, we do agree with Schroeder that the problem arises for the content of motor intentions, whose function, as he

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puts it, is to cause an agent to grasp, e.g., a cookie, and not to track her grasping it.

Schroeder's question whether the teleosemantic account could be extended to the contents of mental representations with a world-to-mind direction of fit, or whether it should be restricted to the contents of mental representations with a mind-to-world direction of fit, is an excellent one. But it is a question for *all* teleosemantic accounts of the contents of "indicative" belief-like mental representations, not one that should be particularly addressed to us. As Schroeder observes, we do hold that motor intentions are mental representations and that they guide responses that are actions, not reflexes. Furthermore, in §7 of Chapter 6, we do appeal to psychophysical experiments on illusory stimuli (i) exhibiting a dissociation between perceptual responses and visuomotor responses and (ii) showing that visuomotor representations can be fooled into representing two-dimensional features as three-dimensional features of the visual display. So, in order to argue that visuomotor representations of a target of action are genuine mental representations, we do not, as Schroeder notes, directly appeal to the fact that they have informational functions. But, although Schroeder is right to say that our grounds for the claim that visuomotor representations are genuine mental representations rest on the fact that like visual percepts, they can be illusory, nonetheless what we are arguing (in §7 of Chapter 6) is that visuomotor representations are genuine mental representations, not that motor intentions are. On our view, the job of a visuomotor representation is to present visual information about a target of action to an individual's motor intention. In §8 of Chapter 6, we further argue that since visuomotor representations present visual information for the benefit of an individual's motor intentions (with a world-to-mind direction of fit), they are, like Millikan's pushmi-pullyu representations, hybrid representations (with both directions of fit). So, in a sense, on our own analysis, even though they present visual information in a format suitable to motor intentions, it is nonetheless the function of visuomotor representations to track facts.

Further, Schroeder raises the query whether one can consistently think of mental representations with a mind-to-world direction of fit both as physical structures with informational functions and as misrepresentations (e.g., visual illusions). We do think that one can and we also think that Schroeder would probably agree with us about this. Here is why. On our view, the teleosemantic hypothesis that physical device *S* derives its content from its having some informational function *explains* why some states of *S* can be misrepresentations by failing to fulfill *S*'s function, which is to indicate the presence of some property. Since the former is a sufficient condition for the latter, the two are consistent.

Second, Schroeder offers an accurate account of our grounds for our claim that, unlike visual percepts, visuomotor representations fail to make

an agent visually aware of her target, which is to say that, unlike a visual percept, a visuomotor representation fails to satisfy the constraint of contrastive identification. On the one hand, Schroeder presses us for more justification. The reason why, unlike visuomotor representations, visual percepts do satisfy the constraint of contrastive identification is that visual precepts represent the spatial position of an object in an allocentric frame of reference and not in an egocentric one.

On the other hand, he offers one reason for scepticism and one straight counter-example. His reason for scepticism is that people offered two different bars of chocolate to taste might well claim that the two bars taste different while being unable to state exactly how they are different. But the fact that people fail to find words to express their experience of the contrasting tastes (of two chocolate bars) does not show that they are phenomenally unaware of the different tastes. What it may show is that, although they do experience the contrasting tastes, they fail to conceptualize and name the contrast. All the constraint of contrastive identification says is that the basis for visual consciousness of an object lies in the fact that the object's visual features are made available for comparison. It may well be that subjects will fail to report the result of the comparison unless they can name it and hence conceptualize it.

Next, Schroeder offers a purported counter-example to our claim that, unlike visual percepts, visuomotor representations fail the constraint of contrastive identification. His counter-example is that, by using a visuomotor representation, an agent can orient her hand so as to match the orientation of a slot and thereby successfully insert a card into the slot. But, according to Schroeder, she could not succeed unless she compared her visuomotor representation of the angle of her hand (or wrist) with her visuomotor representation of the slot's angle. "But," Schroeder adds, "this sounds like constrastive identification." It would indeed so sound if agents did so proceed. But this is not how agents proceed, since such experiments are performed in so-called "open-loop" condition, i.e., while agents have no visual access to their own hand. Rather, what happens in such visuomotor tasks is that agents automatically calibrate the orientation of their hand with the orientation of the slot. Similarly, in a visuomotor task of grasping a target in an open-loop condition, the agent's finger grip automatically unfolds without the agent's visual control of her hand and finger movements.

2. Reply to Alva Noë

Whereas Tim Schroeder is sympathetic to our broad representationalist framework for elucidating the puzzles of human vision, Alva Noë thinks it is deeply misguided. Noë ascribes to us a view of visual experience, which he calls the "picture picture of seeing" and which, according to him,

fails to do justice to the two major functions of visual experience: its action-guiding role and its reference-grounding role.

First, let us get rid of a first putative misunderstanding raised by Noë's use of the expression "the picture picture of seeing." As the passage from our book quoted at the beginning of Noë's comments shows, we do assume that, unlike the conceptual content of a thought, the non-conceptual content of a visual percept cannot represent a mug as being to the left of a telephone without embedding this information within some richer and more detailed information about how far the former is from the latter and about the orientation, shape, size, colour, etc., of both the mug and the telephone. So, on our view, the non-conceptual content of a visual percept representing a mug to the left of a telephone is pictorial to the extent that it is informationally richer and more fine-grained than the conceptual content of a thought expressible by the use of the English sentence "the mug is to the left of the telephone." The latter can, but the former cannot carry the information about the spatial relation between the mug and the telephone without depicting the distance between them, the orientation, shape, size, and colour of both the mug and the telephone. Our official view (p. 27) is that, whereas a thought that some relation *R* holds of objects *a* and *b* is a state produced by a mechanism with the function to carry information about instances of *R* in digital form, a visual experience of *Rab* is a state produced by a mechanism with the function to carry information about the same state of affairs in analog form.

However, as we point out in §2.3 of Chapter 1, we emphatically reject the view that what makes one visually aware of a mug as being to the left of a telephone is one's perception of a mental picture (or sense-datum), located in one's mind (or brain), and representing a mug to the left of a telephone. One is made visually aware of the mug and the telephone by a physical process that starts when one's retina is being hit by photons that are reflected by these objects, which in turn leads to further visual processing higher up in one's visual cortex.

Now, we fail to see why or how acceptance of the distinction between the conceptual content of thoughts and the non-conceptual content of visual experiences should force us to endorse a view of the content of visual experience as either "comparable to an unasserted propositional content, or the content of a Fregean thought" or as "a way of encountering a pictorial description . . . of the way a world might be." Since we fully acknowledge the point that visual percepts are caused by what they represent, we are committed to the view that visual experience represents facts (or actual states of affairs)—not "the way a world might be."

Second, Noë claims that our endorsement of what he calls the "picture picture of seeing" commits us to a descriptivist account of the content of visual experience—an account which is, as he puts it, "the pictorial analog of descriptions." If so, then it would be hard to see how visual experience

could secure reference to particular things and objects: it would be hard to see how one could get reference to a particular object from a purely descriptive representation of it. Thus, our "picture picture of seeing" would make us unable to account for the reference-grounding role of visual experience. This is, we take it, what Noë characterizes as the problem of getting "particularity from generality, i.e., the experience of *this cup* as distinct from that of *a cup* with a certain appearance."

In response, we want to make two points.

First, the content of the verbal report of a visual experience is one thing; the content of the reported visual experience is another. In the quoted passage from our book, we simply comply with the semantic and pragmatic constraint according to which in verbally reporting the content of a visual experience of the relation between a pair of objects, the first time one refers to the pair of objects, one ought to prefix each noun phrase by an indefinite description before being able to use some directly referential expression (such as a demonstrative concept, e.g., "that mug"). But it would be a mistake to infer that one accepts a descriptivist account of the content of visual experience from the fact that the meaning of the utterance by means of which one is verbally reporting the content of the visual experience includes the meaning of an indefinite description.

Second, although visual experience may well have a reference-grounding role, nonetheless perceptual experience, on our view, is one thing and reference is something else. Arguably, one cannot visually experience the shape and colour of an object unless one perceives the object. But it is necessary neither to refer to an object in order to visually experience its shape and colour, nor to perceive an object in order to refer to it. Reference is achieved by thought, the content of which may in turn include a demonstrative concept of the object referred to. If it does not, then it includes some descriptive concept instead. We thus submit that the question whether a mental representation directly refers to an object or whether it picks the object descriptively can only arise for representations with some conceptual content or other, not for visual experiences with non-conceptual content.

Turning now to the action-guiding role of visual experience, it is hard to determine the extent of our disagreement with Noë. Since we embrace a version of the two-visual systems model of human vision, we certainly do not deny that it is one fundamental function of human vision to guide action. But the fact that vision guides reaching and grasping does not mean that visual experience does. We do not disagree with Noë when he explicitly accepts the fundamental dissociation between the visuomotor representation and the visual experience of an object's shape, as when he writes: "you do not need consciously or attentively to experience the shape of something to know roughly how far you need to separate your fingers in order to pick it up smoothly." As far as we can see, this is as a good a

statement of the two-visual systems model of human vision as any. In *Ways of Seeing*, however, we emphasize the distinction between lower and higher levels of the pragmatic processing of visual information, involved respectively in reaching-to-grasp a target and in the skilled manipulation of tools. But recognition of the existence of levels of both pragmatic and semantic processing of visual information is consistent with the basic claim of the two-visual systems model,, according to which visual experience can be dissociated from visually guided action.

As our example of the basket of fruits (in the Précis) shows, visual experience is involved in the selection of a target of a low-level act of reaching and grasping. But it does not guide the fine-tuning of the bodily movements involved in grasping the target. As Noë notes, the brain could not switch from the selection task to the visuomotor task unless it could transform the allocentric representation of the position of the object (suitable for perception) into an egocentric representation (suitable for acting on the object). This is a straight scientific question. We fail to see what Noë's mysterious grounds are for asserting that it is a "deeper" and "intractable" problem.

3. Reply to Pierre Poirier and Martin Ratte

Whereas Noë's concern was that we might deprive visual experience of both its action-guiding role and its reference-grounding role, Pierre Poirier and Martin Ratte's goal is to mount an attack on the role of mental representations in the explanation of action. Their official perspective is that of dynamical systems theory, in which an agent and her environment are two non-dissociable parts of a system that seeks its own equilibrium. It is instructive and challenging to see how a non-representationalist framework radically different from our own might be developed as an alternative account of some actions. We shall first address some general clarificatory issues. Then, we shall examine Poirier and Ratte's criticism of an argument in favour of a representational approach to the explanation of action they ascribe to us. Finally, we shall argue that their account is a version of behaviourism.

To start with, we would like to make a couple of general remarks, the first of which is that, from our standpoint, Poirier and Ratte's version of the dynamical theory of action is hard to evaluate since they fail to engage with the particular cases of dissociation between visual processing according to whether the task is perceptual or visuomotor, which are at the core of our own account. Our second clarificatory remark is that, contrary to what Poirier and Ratte say, we do not intend our own representationalist account of the contribution of the dorsal stream of the human visual system to be an account of expert motor action (as exemplified by an experienced tennis player). Our characterization of the visuomotor transformation (achieved by the human superior parietal lobule) is meant to be

an account of the contribution of low-level pragmatic processing of visual information to low-level acts of reaching-and-grasping a target. Furthermore, we do emphasize the contribution of the left inferior parietal lobe to the higher-level pragmatic processing involved in the skilled manipulation of tools. And, unlike Milner and Goodale's earlier version of the two-visual systems model, we do emphasize the contribution of the right inferior parietal lobe (hence, of the dorsal stream) to visual consciousness.

We now move to Poirier and Ratte's reconstruction and criticism of a putative argument in favour of the role of representations in the explanation of action they think we endorse. First of all, we are reluctant to endorse their reconstructed argument. Second, we do not really understand part of Poirier and Ratte's answer to the argument. The reason we think that we cannot endorse the reconstructed argument is that it is cast in terms of *actions*. Poirier and Ratte ascribe to us the view that if and when an agent's action can be both erroneous and sensitive to non-local properties of the agent's environment, then it must be caused by the agent's mental representations. Now, from their comments, it is quite clear that Poirier and Ratte equate action and motor output. Of course, an act can be judged to be morally wrong, but, on our view, only a (mental or non-mental) representation—not a motor output—can be erroneous in the relevant non-moral sense: only representations can misrepresent something or other. A motor output (or an executed action) can fail to satisfy the intention (or desire) of a healthy ageny—for some exogenous reason or other, the execution of an action may fail or abort. As neuropsychology shows, some apraxic patients do perform inappropriate actions involving the skilled use of tools. For example, an apraxic patient might draw a toothbrush through her hair, instead of using a comb. However, what her inappropriate act shows is that such an apraxic patient either misrepresents the function of the relevant tool or she associates an inappropriate motor representation with her perception of the tool.

Nor do we really understand Poirier and Ratte's argument that some motor acts can be sensitive to non-local properties of the agent's environment. Their argument is puzzling for at least three reasons. They argue that the activity of area V1 of the primary visual system can respond, not just to retinal signals, but also to signals coming from other neighbouring brain areas (such as V2). First of all, in what sense should the activity of V2 count as some non-local property of the agent's environment, relevant to the activity of V1? Second, the activity of area V1 of the primary visual system is known to underlie visual experience, not motor acts. Far more relevant to motor acts is the activity of the primary motor area M1. Third, the activity of an agent's brain area is not a motor act. The question they should address, from their own perspective, is whether an agent's motor act is sensitive to some non-local properties of the agent's environment, not whether some of the agent's brain area is.

Finally, we want to explain why Poirier and Ratte's version of the dynamical theory of action seems to us suspiciously like a version of behaviourism. On their proposed account, an agent's action is a behavioural response to some disturbance designed to re-establish a temporarily disrupted equilibrium in the dynamical system. Clearly, this account could only apply to an agent's *overt* or *executed* actions. But this restriction runs against the scientific study of motor cognition. As one of us (Marc Jeannerod) has argued in much of his scientific career, there is much empirical evidence that an agent's motor system is activated in two situations in which he or she fails to perform any overt action. On the one hand, parts of an agent's motor system are active when he or she plans and/or imagines an action, which, for some reason or another, he or she fails to execute. In fact, we all plan many actions that are never accomplished. On the other hand, some areas of an observer's motor and premotor systems (e.g., mirror neurons) are active when he or she perceives actions performed by another agent. This evidence suggests that much of the activity of an agent's motor system underlies motor representations of an action regardless of whether the represented action is being performed by the agent whose motor system is representing the action.